

Homework 3

1. A rectangular pontoon 12 m long and 8 m wide and 3 m deep weighs 750 kN . It carries a boiler of 5 m diameter weighing 550 kN . The center of gravity of pontoon is 1.5 m from the bottom and the center of gravity of boiler is 2.5 m from the pontoon's top edge, both passing through the same vertical axis. Find the metacentric height about its longest and shortest centreline, and determine whether the boiler parallel to both sides will be carried safely.

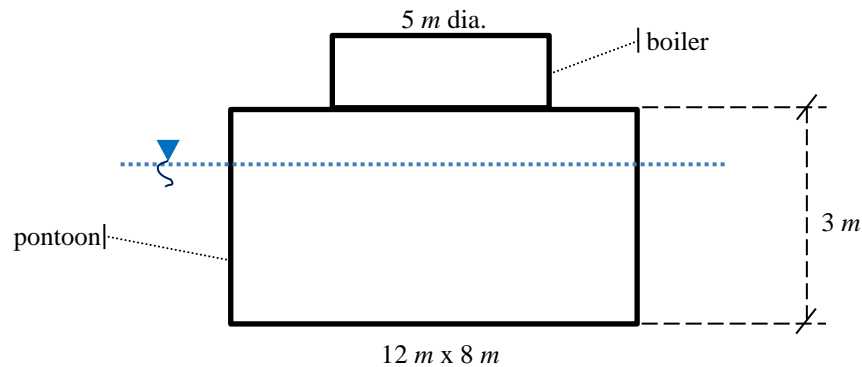


Figure 1

2. A cylindrical container 8 m high and 3 m in diameter is reinforced with two hoops 1 m from each end. When filled with water, what is the tension in each hoop due to water?
3. A closed rectangular tank 4 m long, 2 m wide, and 2 m high is filled with water to a depth of 1.8 m . If the allowable force at the rear wall of the tank is 200 kN , how fast can it be accelerated horizontally?
4. An open vertical cylindrical vessel, 2 m in diameter and 4 m high is filled with water to the top. If rotated on its own vertical axis in order to discharge a quantity of water to uncover a circular area at the bottom of the vessel 1 m in diameter, *a)* determine the angular speed in *rpm*, and *b)* how much water is left in the cylinder after rotation?
5. A closed vertical cylindrical vessel, 1.5 m in diameter and 3.6 m high is $\frac{3}{4}$ full of brine ($s = 1.3$) and is revolved about its vertical axis with a constant angular speed. The vessel is made up of steel 9 mm thick with an allowable tensile stress of 85 MPa and has a small opening at the center of the top cover. *a)* If the angular speed is 210 rpm , what is the maximum stress in the walls? *b)* To what maximum angular speed can the vessel be revolved?
6. Three vertical stems which are 300 mm apart are connected to a single horizontal tube. The tube is filled with water to a depth of 300 mm in the vertical stems. How fast should it be rotated about the middle stem to just zero the depth of water in the stem?